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Sixty-Fourth Annual Report of the Visitors
of the University Observatory for 1938.

Physical &
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F. A. LINDEMANN, M.A., F.R.S., Fellow of Wadham and Student of Christ Church.

E. A. MILNE, M.A., F.R.S., Fellow of Wadham.

G. M. B. DOBSON, M.A., D.Sc., F.R.S., Fellow of Merton.

This report refers to the calendar year 1938.

I. Staff.

The scientific staff of the observatory is composed of the director and the following assistants—

Chief Assistant (Seismology): J. S. Hughes, New College.

Radcliffe Travelling Fellow in Astronomy: H. Zanstra.

Research Assistants (Astronomy): Miss M. G. Adam, St. Hugh's College; D. S. Evans, King's College, Cambridge.

Seismological Assistant: Miss E. F. Bellamy.

Dr. T. L. Page resigned his appointment as chief assistant in astronomy on 1 September, to accept a post at the University of Chicago and the Yerkes Observatory. Mr. D. S. Evans was

appointed research assistant and took over his duties on 1 October.

II. Instruction.

The following courses of lectures have been delivered at the observatory:

<i>Term.</i>	<i>Subject.</i>	<i>Number attending course.</i>
<i>By the director:</i>		
H. 1938	Practical Astronomy	10
M. 1938	Astrophysics	3
M. 1938	Field Astronomy	12
<i>By Dr. Zanstra:</i>		
H. 1938	Radiation Pressure in Nebulae	5

In addition Miss Adam continued her work for the degree of D.Phil., while T. L. Page completed his work and was awarded the degree.

With the collaboration of Professor Milne the usual colloquium in astrophysics was held during all three terms. The observatory was further regularly open on Saturday nights during the Hilary and Michaelmas Terms, and by arrangement at other times. Some 100 members of the University have availed themselves of these opportunities to see the observatory.

III. Equipment.

A new Cassegrain mirror, giving an aperture ratio of $f/62$, was obtained for the solar telescope from Grubb, Parsons in July. Hartmann tests in August showed that the zonal aberration with this mirror is negligible, and that the residual astigmatism of the telescope amounts to 0.7λ . This astigmatism has now been definitely traced to the two large flats, and is probably due to a slight cylindrical deformation of their surfaces; in this latter event the astigmatism is insensitive to the angle of inclination at which the mirrors are used. Since this aberration may in any case be regarded as small for a solar telescope, these tests have

now been concluded and a paper containing a description of the instrument and the tests has been communicated to the Royal Astronomical Society.

The essential mechanical parts of the solar spectroscope were completed and installed during the first half of the year. These included the mechanical controls, a metal-lined tube for carrying the light beam (constructed by Mr. G. Neale), and the system for temperature regulation. The spectroscope was brought into use in September; a preliminary study revealed that the definition was much improved by diaphragming off the lower half of the prism train, and the spectroscope in this form was in continuous use with the solar telescope for the balance of the year. A further study will shortly be undertaken of the nature and the origin of the aberrations in the spectroscope.

IV. Work.

Astrophysics. Miss Adam has continued her work on the strengthening of faint lines towards the solar limb. Calibrated spectra have been obtained with a dispersion of 0.4 \AA per mm. of a region near $\lambda 4100$ containing some 50 faint lines, half of which are members of strong multiplets, and half are faint on account of the rarity of the element. Once the calibration of the Zeiss step wedge in this region has been completed, the measurement of these plates will determine if interlocking is primarily responsible for the observed strengthening towards the limb. Earlier in the year Miss Adam completed her study of the Swan band, and derived from the intensities of the rotational lines the low excitation temperature of 4800° K in the solar atmosphere. This temperature is in agreement with that derived from studies of atomic lines.

Apart from work in connexion with new equipment, detailed under III, the director has continued his numerical integrations of the equation of transfer for absorption lines. Seventeen unsuccessful trial solutions have been made, but a method has now been found of deriving a fairly accurate preliminary variation of η with optical depth, and it is expected that it will be

possible to use iterative methods to complete the solution. Pending the completion of this problem, work on the surface brightness of the sun has been temporarily suspended.

In order to investigate whether, as suggested by Unsöld, the Balmer lines act as if formed by pure absorption ($\epsilon = 1$), Mr. Evans has obtained spectra of $H\alpha$ with the new solar spectroscope at various points on the solar disk. The spectroscopic resolving power for this work is being determined from the known profiles of the narrow D lines formed in a short absorption tube.

Dr. Page completed the measurement of the intensities of the Balmer lines and continuum, and the Paschen continuum in the electrodeless discharge. These measures yield the ratio of Paschen to Balmer continuous spectra predicted by the Kramers-Gaunt law, though owing to a numerical error this was not at first recognized, and consequently suggest, in the light of Page's earlier work on Balmer continuous and line spectra in the planetary nebulae, that current theories on the origin of nebular luminosity may have to be revised.

In connexion with his work on the solar chromosphere, Dr. Zanstra has experimentally discovered an apparently new form of instability in fluid motion. In a paper communicated to the Royal Astronomical Society he has suggested that the motion of prominences in streams, so beautifully shown in Lyot's motion pictures, is a consequence of this instability, while the luminosity may be attributed to the partial conversion of the large available kinetic energy into energy of excitation and ionization.

Astrographic Catalogue. Apart from five plates still awaiting measurement in zone $+33^\circ$, Mr. H. Scott Barrett, whose part-time service the observatory owes to the generosity of the Radcliffe Trustees and the Astronomer Royal, has completed the determination of plate constants, and the preparation of the copy for press for both this zone and zone $+32^\circ$. Of the 320 plates in these 2 zones, 76 have been measured by Mr. Burnet, employed through the generosity of Dr. Wilfred Hall, while the remainder have been measured by Mr. Cook. Following a grant

made by the International Astronomical Union at its meeting in Stockholm in August, it is hoped to proceed with the printing of the volume for zone $+32^{\circ}$ during 1939.

Seismological Summary. A vexatious source of delay in the preparation of the Summary is occasioned by the disproportionate amount of time involved in finding epicentres from inadequate and poor material. It has been decided that in future no determination of an epicentre will be made unless there are at least three consistent sets of P and S readings, an exception of course being made where an epicentre has already been assigned by an observer from local evidence. It is hoped in this way, without rendering the Summary any less useful, slightly to reduce the slowly but steadily lengthening interval between the year of appearance of the Summary and the year of the epicentres to which it refers.

During the year under review three quarterly issues of the Summary have been printed and distributed, while a fourth is nearly through the press. In addition the epicentres for two further quarters have been determined, and copy is nearly ready for press.

V. Publications.

The following papers have been published during the year as a result of work done at the observatory:

- M. G. Adam. 'Molecular Carbon in the Solar Spectrum', *Monthly Notices, R.A.S.*, vol. 98, p. 544.
- J. S. Hughes and E. F. Bellamy, *The International Seismological Summary*, Parts 3, 4, 1932. Part 1, 1933. (County Press.)
- T. L. Page. 'Kramers' Absorption Law in Astrophysical Problems', *Nature*, vol. 141, p. 1137.
- T. L. Page. 'Kramers' Law: A Correction', *Nature*, vol. 142, p. 614.
- H. H. Plaskett. 'Polar Aurora and Night-Sky Light', *Occasional Notes, R.A.S.*, No. 2, p. 13.
- H. Zanstra, 'On the Relative Line Intensities in Nebulae', *The Observatory*, vol. 61, p. 295.

The first of these papers appeared in its reprint form as Communications from the University Observatory, No. 12.

VI. Miscellaneous.

The Rev. M. P. M. McLean (Worcester) has signified his intention of leaving the sum of £400 to the Chancellor, Masters and Scholars of the University of Oxford, to be used in whatever way the Savilian Professor of Astronomy may deem best.

The following astronomers and physicists have visited the observatory during the year: Professor H. D. Curtis, Professor Y. Hagihara, Dr. J. S. Hall, Dr. W. E. Harper, Mr. M. Humason, Dr. H. von Klüber, Dr. G. P. Kuiper, Professor F. C. Leonard, Professor A. O. Leuschner, Dr. A. van Maanen, Dr. P. W. Merrill, Professor H. F. Newall, and Professor R. W. Wood. In addition Dr. Samaha of the Helwan Observatory worked for two weeks in January at the observatory.

H. H. PLASKETT.

UNIVERSITY OBSERVATORY,
OXFORD.

6 January 1939.

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OXFORD, ENGLAND

